Appendix 7.1: GHG Emission Calculations

7.1 Introduction

7.1.1 This technical appendix to the Environmental Statement (ES) details the calculation of construction- and operational-stage greenhouse gas (GHG) emissions from the Proposed Development.

7.1.2 It should be read alongside Chapter 7 of the ES, which sets the magnitude of GHG emissions in a policy context to judge the significance of effects on climate change.

7.2 Construction

Emission sources

7.2.1 The Proposed Development comprises:

- a data centre building;
- an ancillary block with support and office space;
- an energy centre;
- security measures;
- car parking and access; and
- landscaping.

7.2.2 Construction and fit-out of these elements will cause direct and indirect GHG emissions from the fuel and energy used by construction plant and in the 'embodied carbon' of materials used. The embodied carbon refers to the indirect emissions in the supply chain for those materials: extracting and transporting the raw materials, manufacturing them into products, and delivery of those products to site.

7.2.3 Together with the assembly work on-site, this comprises modules A1 to A5 in the terminology used to describe life-cycle carbon assessment. A1-3 refers to the materials manufacturing supply chain; A4 is delivery to site; and A5 is assembly on site.

7.2.4 The main elements of the development relevant to construction-stage GHG emissions for the buildings are as follows:

- substructure;
- superstructure, including frame, upper floors, roof, stairs and ramps, external walls, windows and external doors, internal walls and partitions and internal doors;
- finishes including wall, floor and ceiling finishes;
- fittings, furnishings and equipment (FF&E);
- building services/MEP;
- prefabricated buildings and building units;
- work to existing building; and

- external works.

7.2.5 Some matters of M&E plant and the fit-out of buildings will be for future tenants, depending on their requirements. In particular, the choice of datacentre IT equipment would be a matter for tenants, but as this may be a material contributor to the whole-life carbon impacts, an estimate has been made at this stage.

7.2.6 Landscaping is likely to involve a mixture of habitat creation, including grassland and scrub and some areas of tree planting. While tree planting in particular has the potential to provide carbon sequestration over the lifetime of a development, the area of planting at this site is not such that this would be material to the overall carbon balance, so it has not been assessed further.

Construction stage calculations

Building envelope WLCA

7.2.7 HDR, the project engineers, have undertaken a Whole Life Carbon Assessment (WLCA) for the Proposed Development, the results of which are presented in a WLCA report and the Greater London Authority (GLA) WLCA template, submitted alongside the planning application. The WLCA has calculated GHG emissions for lifecycle modules A1-A5 for the building envelope to shell & core stage, excluding the fit-out of the data centre with tenants' IT equipment. The results of this WLCA, as presented in the GLA WLCA template, are reproduced in Table 7.1.

7.2.8 The WLCA calculates GHG emissions in the order of 41,044 tCO_2e, or 1.22 tCO_2e/m^2.

Table 7.1 Construction-stage GHG emissions for the Proposed Development building fabric

Building element	GHG emissions ($kgCO_2e$)		
	Life-Cycle Stages A1-A3	Life-Cycle Stage A4	Life-Cycle Stage A5
Substructure	5,478,245	775,413	265,978
Superstructure	8,135,522	631,642	474,091
Finishes	755,939	54,657	107,699
Fittings	1,697	183	2
Building Services/MEP	9,036,292	443,055	155,009
Prefabricated buildings and building units	12,120,433	520,647	0
Work to existing building	-	-	-
External works	334,693	40,923	12,212
Other site construction impacts or overall construction stage [A5] carbon emissions not specific to an individual building element category	-	-	1,699,437
Totals ($kgCO_2e$)	35,862,821	2,520,994	2,714,427
Totals (tCO_2e)	35,863	2,521	2,714

**excluding minor potential for sequestered biogenic carbon through use of timber products and in external works*

Fit-out embodied carbon

7.2.9 The embodied carbon of IT equipment within the datacentre has been excluded from the scope of the WLCA. The footnote to Table 4 in the WLCA explains that this is because the scope of assessment is limited to the building shell & core stage only, which is stated to be in line with the GLA's guidance for the WLCA. An estimation of the materiality of excluded items to the total carbon impact is not provided.

7.2.10 For the purpose of EIA it is necessary to include direct and indirect impacts insofar as these are material and it is proportionately possible to do so from available information, whether quantitatively or qualitatively. Fit-out of the datacentre with IT equipment (and refreshes of that equipment during its operating lifetime) is an indirect impact of the development from the embodied carbon of the equipment, i.e. causing GHG emissions from its manufacture, primarily overseas.

7.2.11 Research suggests that the embodied carbon of high-performance IT equipment likely to be used in a datacentre can potentially be substantial, both in the initial installation and then the potential for equipment refreshes over its operating lifetime due to the rapid development and deployment of new equipment for demanding workloads such as machine learning.

7.2.12 However, this is an emerging area of research. Most vendor-specific information and most published studies of typical datacentre or machine learning GHG impacts focus on operational energy consumption rather than the embodied carbon of manufacture.

7.2.13 The specific IT equipment that will be installed in the Proposed Development is not known at this stage. It would depend on tenants' needs for particular computing workloads. This introduces substantial further uncertainty into an estimation of potential impacts, which would need to be scaled from published studies to the Proposed Development using a normalisation to MW of power or perhaps m^2 of rackspace. A better scaling metric may be performance, measured in FLOPS (for general compute) or TOPS (for machine learning) plus TB of NAND memory capacity and storage; however, this is not possible without knowing the IT systems to be installed.

7.2.14 Given these uncertainties, a proportionate approach for the EIA is to make a best estimate of the likely order of magnitude of impact from an initial and limited review of published studies. This can give an indication of whether the effect may be significant or not in context of the overall whole-life carbon impact of the Proposed Development.

7.2.15 Three open-access studies have been reviewed. In Energy Proceedings Vol 55 (2025), d'Orgeval *et al* published a lifecycle assessment[1] of high-performance or AI datacentres based on a reference design. In 2023, Li *et al* submitted a paper to the ACM/IEEEM SC '23 conference[2] reviewing the carbon footprint of three top-500 supercomputer systems, analysing

[1] d'Orgeval, A. *et al* (2025): Carbon Footprint of AI Data Centers: A Life Cycle Approach. Energy Proceedings Vol. 55. https://www.energy-proceedings.org/carbon-footprint-of-ai-data-centers-a-life-cycle-approach/, accessed 10/03/25

[2] Li, B. *et al* (2023): Towards Sustainable HPC: Carbon Footprint Estimation and Environmental Implications of HPC Systems. SC '23: Proceedings of the International Conference for High Performance Computing, Networking, Storage and Analysis, Article 19. https://dl.acm.org/doi/10.1145/3581784.3607035, accessed 10/03/25

differences in configuration. And in 2019, Dell published a life-cycle assessment[3] of a more conventional R740 general-purpose rackmount server, going into detail about this particular product.

7.2.16 The d'Orgeval *et al* paper shows 185,000 tCO_2 for IT equipment in a reference design datacentre stated to have around 3.60 MW power consumption. Normalising per MW, this is equivalent to 51,389 tCO_2 of embodied carbon for IT equipment with 1 MW power consumption. The study concludes that the embodied carbon of manufacturing the IT equipment is about equal to the carbon emitted due to power consumption during 20 years' use, with a French (relatively low-carbon) electricity mix.

7.2.17 The reference datacentre design the study draws from is published by Schneider Electric[4] for a two-hall building outfitted with IT equipment suited to a mixture of AI and conventional workloads, which shows IT equipment power consumption of up to 3.82 MW and total power (cooling and other building power uses) of 6.25 MW: this is a ratio of IT equipment power draw to total datacentre power draw of around 0.61. Applying this ratio to the Proposed Development suggests that 21.19 MW of the peak 34.69 MW peak power use reported in the Energy and Overheating Statement submitted with the planning application for the Proposed Development would be for the IT equipment, if configured in a similar way as the Schneider Electric reference design.

7.2.18 If the embodied carbon is 51,389 tCO_2 for IT equipment with 1 MW of power draw, scaling this up to the Proposed Development yields an estimate of 1,088,875 tCO_2 in total. This is an extraordinary figure, especially when compared to the 41,530 tCO_2e for the building and M&E plant calculated in the WLCA. However, it is broadly consistent with the WLCA in terms of the ratio of embodied carbon to operational carbon: the 41,044 tCO_2e/annum from energy consumption would be 820,852 tCO_2e total over 20 years' life to match the d'Orgeval *et al* scenario.

7.2.19 Dell's study concludes that a single Dell R740 2U server blade with two Intel Xeon CPUs at 140 W TDP each, 384 GB of RAM and nine SSDs with 27.6 TB of storage, has 4.29 tCO_2 of embodied carbon from its manufacture. A datacentre may have several hundred or even thousand such servers arranged in racks. Peak power use is 510 W. Scaling this to the Proposed Development's estimated IT power load in the same way described above yields an estimate of 178,153 tCO_2: much less than the d'Orgeval *et al* paper but still several times the embodied carbon of the datacentre building and M&E plant calculated in the WLCA. Interestingly, Dell's product lifetime assumed in the study is only four years, giving an indication of the typical high refresh rate for IT equipment and consequent importance of measuring not just the initial embodied carbon (the A1-A5 modules in LCA terminology) but also the replacement of equipment (LCA module B4).

---

[3] Dell (2019): Life Cycle Assessment of Dell PowerEdge R740. https://corporate.delltechnologies.com/content/dam/digitalassets/active/en/unauth/data-sheets/products/servers/lca_poweredge_r740.pdf, accessed 10/03/25

Busa, A. and Hegeman, M. (2019). Life Cycle Assessment of Dell R740. Thinkstep AG on behalf of Dell. https://www.delltechnologies.com/asset/en-us/products/servers/technical-support/Full_LCA_Dell_R740.pdf, accessed 10/03/25

[4] Schneider Electric (not dated): EcoStruxure™ Reference Design 99. 3818 kW, Tier III, IEC, Chilled Water, Liquid-Cooled & Air-Cooled AI Clusters. https://www.se.com/ww/en/work/solutions/data-centers-and-networks/reference-designs/, accessed 10/03/25

7.2.20 Finally, the Li *et al* study provides embodied carbon calculations for three specific supercomputer systems. This was a detailed study, providing information such as the higher embodied carbon of GPUs and large RAM pools used increasingly in systems for machine learning workloads compared to more conventional CPU-focused systems. Its conclusions were more difficult to apply to the Proposed Development due to being normalised primarily to FLOPS of performance, but scaling was possible using the results for the relative carbon footprint contribution of different components in the systems. The Frontier and LUMI supercomputers studied each have AMD EPYC 7763 or 7742 CPUs with 64 cores (as configured in 2022, the reference design used in the Li *et al* study). The embodied carbon of each CPU is shown in the study to be around 15 $kgCO_2$ and the CPUs collectively constitute 5% and 12% of the total embodied carbon of the systems respectively (Figure 1 and Figure 5 in the study). The 'Green Top500' database referenced in the study for the systems' configuration in 2022[5] shows 8,730,112 and 2,220,288 cores respectively, which would be 136,408 and 34,692 physical CPU dies, and shows system power consumption of 24.6 MW and 7.1 MW respectively.

7.2.21 Scaling this to total system embodied carbon and then, by power draw, to the Proposed Development, suggests embodied carbon ranging from 12,931 tCO_2 to 35,238 tCO_2. This is an order of magnitude lower again than the studies referenced above. It is internally consistent with the study's conclusion that the embodied carbon payback period for refreshing hardware to give better compute performance per Watt is only a few years in a location with a middling carbon intensity electricity supply, comparable to the UK.

7.2.22 This difference in embodied carbon might be due to the supercomputer designs being optimised for a specific, high-performance computing purpose, rather than being a datacentre design that is more flexible for a range of workloads. It might also reflect the choice of supercomputers on the 'Green500' list for the study (the Frontier and Lumi systems were ranked #1 and #3 respectively in 2022 for green performance), although this is understood to focus on operational energy and other sustainability indicators rather than embodied carbon.

7.2.23 From the three open-access lifecycle assessment studies used here, results scaled to the Proposed Development range over two orders of magnitude. Other studies reviewed did not disaggregate their results sufficiently to be useful here, or normalised them to FLOPS/TOPS of performance, which may be a better scaling metric but could not be applied to the Proposed Development as the performance of tenants' IT equipment is unknown at this stage. A key uncertainty here, therefore, is scaling from the studies' results to the Proposed Development using MW of power consumption. The studies note that NAND memory (used in RAM and SSDs) is a substantial part of the embodied carbon of high-performance systems, but contributes much less to the power consumption than CPUs and GPUs.

7.2.24 Overall, two conclusions can be drawn from this. Firstly, whichever results are realistic for the Proposed Development, it is clear that the embodied carbon of IT equipment is likely to make a material contribution to the whole-life carbon impact and hence contribute to the significance of effect. This is particularly the case when considering the likelihood of it being regularly replaced or upgraded in use, meaning the B4 stage impacts could come to outweigh the initial A1-A5 embodied carbon.

7.2.25 Secondly, while total direct and indirect GHG emissions caused by the Proposed Development are a matter for the significance of effect under the EIA Regulations, and hence a factor in the

[5] PROMETEUS Professor Meuer Technologieberatung und -Services GmbH trading as Top500 (2022): Green500 November 2022. https://www.top500.org/lists/green500/2022/11/, accessed 10/03/25

planning balance, it is difficult to see how the embodied carbon of IT equipment can be directly mitigated by the applicant. This depends on the choice of equipment and supplier by tenants of the datacentre in due course. However, there is an opportunity for tenants to be aware of this impact and to engage with suppliers to request Environmental Product Declarations (EPDs) to inform their purchasing choice. This is likely to be of interest to tenants who will have both voluntary CSR and mandatory corporate carbon disclosure duties.

GHG emissions from construction traffic

7.2.26 Fuel combustion by vehicles accessing the Proposed Development during the construction phase will cause direct and indirect GHG emissions. These emissions will largely occur outside the physical site boundary.

7.2.27 To the extent that materials transport is included within the supply chain is included in module A4 of the WLCA, it may be double-counting in some degree to separately assess the delivery leg to site, but this is included to ensure impacts are not underestimated.

7.2.28 The Construction Management and Logistics Plan (CMLP) accompanying the planning application summarises the average daily trip generation figures for construction-related HGV journeys for the demolition and construction period have been calculated based on volumes of demolition material/excavated waste material, together with imported concrete, piling and cladding, as well as for the fit-out period. These have been multiplied up to annual figures based on the delivery times established for the Proposed Development, outlined within the CMLP (Monday-Friday only). This amounts to 252 days of annual construction i.e. representing a 5-day workweek, and excludes bank holidays as is a requirement in London Borough of Hillingdon[6].

7.2.29 The CMLP does not indicate a typical HGV haulage distance and so an assumed 1-way distance of 25 km has been used for the purposes of this assessment.

7.2.30 Emission factors for transport have been taken from the Defra and DESNZ company reporting factors including scope 3 upstream emissions[7]. Large rigid non-refrigerated HGVs of >33t GVW have been assumed. A nominal 50% lading factor is assumed, to account for differing fuel economy with laden and unladen inbound and outbound trips.

7.2.31 Trip generation, journey lengths and emission factors are shown in Table 7.2. Construction-phase transport emissions are estimated to be **143 tCO_2e/annum**, which is less than 0.3% of the building envelope embodied carbon emissions.

Table 7.2 Transport emissions calculation inputs

Transport mode	Trip generation (annual, arrivals and departures)	Trip length (km)	Emission factor (kgCO_2e/v.km)
HGV	20	25	1.13

[6] LB Hillingdon (2023): Noise nuisance. [Online] Available at: https://www.hillingdon.gov.uk/article/5157/Commercial-industrial-and-construction-noise, accessed 11/03/2025

[7] DESNZ (2024): Greenhouse gas reporting: conversion factors 2024. [Online]. Available at: https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2024, accessed 11/03/2025

7.3 Operation

Emission sources

7.3.1 The main emission sources in the operational phase would be from generating and supplying energy used in the buildings by tenants (other than that provided on-site by the PV panels), from fuel and electricity used in vehicles for workforce access, from emergency diesel generators, which are required to meet the electrical demand for the data centre in the event of a utility power outage and are also regularly tested, and from leakage of refrigerant gases used within the chillers of the data centre's HVAC system.

Commented [PS1]: Gens also run for some planned maintenance when mains power cannot be connected ie transformer maintenance/repairs, fixed wire testing etc.

7.3.2 Supply of potable water, treatment of wastewater and treatment of commercial waste from tenants are all also associated with indirect GHG emissions. However, the carbon intensity of water supply and wastewater management is low relative to energy and transport, so this has been considered *de minimis* at ~1 tCO_2e and excluded from further assessment. The Proposed Development does not include a once-through water cooling system that can be associated with very high water consumption at some installations.

7.3.3 Waste generation rates are very uncertain to estimate before tenants are known, but data centre-type uses generating card and plastic waste would have largely recyclable waste streams. This is judged unlikely to be a material source of emissions relative to energy and transport, and has not been assessed further.

7.3.4 Finally, there could also be embodied carbon from maintenance and refurbishment work during the buildings' lifetime, captured within the B1-4 stages in the terminology used to describe WLCA undertaken for the building envelope. The embodied carbon emissions from maintenance and refurbishment work to the buildings would be dependent on tenant choices and is difficult to estimate at this planning stage. The WLCA estimates this as a 1.25% uplift on the construction-stage (A1-A5) impacts, which would be *de minimis*. Given the UK trajectory of decarbonisation to 2050, future refurbishment of the building envelope (excluding IT equipment) is likely to have substantially lower carbon intensity than the initial construction stage, so has not been further estimated in this assessment.

7.3.5 As discussed above, it is clear that the embodied carbon of IT equipment installed by tenants is likely to make a material contribution to the operational carbon impact considering the likelihood of it being regularly replaced or upgraded in use, meaning the B4 stage impacts could come to outweigh the initial A1-A5 embodied carbon. This was discussed above through analysis of the three life-cycle studies referenced and is not assessed further in this section.

GHG emissions from energy use

7.3.6 As with the construction stage, HDR, the project engineers, have conducted energy modelling for the Proposed Development, the results of which are presented in the Energy and Overheating Statement. They have calculated operational energy consumption (kWh/yr), the energy use intensity ($kWh/m^2/year$) and the renewable energy generation (kWh/yr) for the Proposed Development.

7.3.7 To calculate the GHG emissions resulting from operational energy use, the expected energy demand, minus that which would be supplied from on-site photovoltaic (PV) energy generation was estimated by HDR. The 2021 carbon intensity of grid-supplied electricity of 0.1360 $kgCO_2e/kWh$ was then applied in line with the GLA June 2022 Energy Assessment

Guidance[8], which references Building Regulations Part L 2021 carbon factors for grid-supplied electricity and is the figure to be used with respect to offset payments. This would be an underestimate of emissions using the present-day emission of grid-supplied electricity, but is likely to be more representative of the Proposed Development's operation in future years.

7.3.8 DESNZ and BEIS publish GHG conversion factors for company reporting in the UK[9] which indicate a present-day carbon intensity of 0.2752 $kgCO_2e/kWh$ including scope 3 supply chain emissions and transmission and distribution (T&D) losses.

7.3.9 BEIS also publishes forward-looking projections of carbon intensity used in government policy appraisal[10], which indicate a projected carbon intensity of 0.1133 $kgCO_2e/kWh$ in 2028 (with the addition of scope 3 emissions from DESNZ). For the purposes of this assessment, the first year of operation of the Proposed Development is assumed to occur in 2028 or later.

7.3.10 The range of impacts with these factors is presented in Table 7.3.

Table 7.3 Operational-stage GHG emissions for the Proposed Development

Total energy consumption (kWh/annum) exc. PV	Energy use intensity (kWh/m^2)	GHG emissions (tCO_2e/annum) - Building Regs Part L Emissions Factor	GHG emissions (tCO_2e/annum) - DESNZ 2024 Emissions Factor	GHG emissions (tCO_2e/annum) - BEIS 2028 Emissions Factor
301,783,760	17,283	41,043	83,057	34,188

7.3.11 The total annual GHG emissions presented in Table 7.3 vary considerably depending on which grid carbon intensity figure is used. The total GHG emissions calculated using the Building Regulations Part L grid carbon intensity figure (41,043 tCO_2e/annum) is less than half of the emissions calculated using the DESNZ 2024 figure (83,057 tCO_2e/annum) but is 20% higher than the emissions calculated using the BEIS 2028 grid intensity figure (34,188 tCO_2e/annum). The DESNZ 2024 figure represents the GHG emissions associated with the supply of electricity via the UK grid for reporting in 2024, whereas the BEIS 2028 figure represents projected GHG emissions in 2028, taking into consideration decarbonisation of the grid. This suggests that the use of the Building Regulations Part L grid carbon intensity figure is appropriate for the purposes of calculating a conservative estimate of operational stage GHG emissions for the Proposed Development in future.

GHG emissions from transport

7.3.12 Fuel combustion and electricity use by vehicles accessing the Proposed Development will cause direct and indirect GHG emissions.

---

[8] Mayor of London (2022): Energy Assessment Guidance: Greater London Authority guidance on preparing energy assessments as part of planning applications (June 2022). [Online]. Available at: https://www.london.gov.uk/sites/default/files/gla_energy_assessment_guidance_june_2022_0.pdf, accessed 11/03/2025.

[9] DESNZ (2024): Greenhouse gas reporting: conversion factors 2024. [Online]. Available at: https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2024, accessed 11/03/2025

[10] BEIS (2023): Valuation of Energy Use and Greenhouse Gas: Supplementary guidance to the HM Treasury Green Book. [Online]. Available at: https://www.gov.uk/government/publications/valuation-of-energy-use-and-greenhouse-gas-emissions-for-appraisal, accessed 11/03/2025

7.3.13 These will largely occur outside the physical site boundary, and although some aspects of development design can influence these emissions – such as its location relative to public transport links; or its provision of electric charging – it is also acknowledged that demand for employment means these emissions may also occur at an alternative site without the Proposed Development. Nevertheless, being a consequence of operational use of the Proposed Development, these are included in the assessment.

7.3.14 Annual average daily traffic generation figures for workers' and visitors' travel have been provided by the transport consultants. As with the calculation of construction-phase transport GHG emissions, these have been multiplied up to annual figures based a five-day working week, excluding bank holidays, which amounts to 252 days. As noted in the Transport Assessment, the trips generated from HGVs or deliveries will be negligible and so have not been assessed further.

7.3.15 This assessment focuses on commuting emissions from the private car trips, and does not further assess emissions associated with bus or rail use (and walking and cycling would be zero carbon), which presents a reasonable worst-case scenario assessment of transport-related emissions.

7.3.16 Commuting distance is based on average trip lengths reported in the Census journey-to-work data[11] for the area of the Proposed Development in Hillingdon, which is approximately 14 km.

7.3.17 Emission factors for transport have been taken from the DESNZ and BEIS company reporting factors[12] including scope 3 upstream emissions. An average-sized car and average powerplant (internal combustion, hybrid or electric) from the current UK fleet has been assumed for commuting, as the Proposed Development includes EV charging for workers who do have electric vehicles.

7.3.18 Trip generation, journey lengths and emission factors are shown in Table 7.6. GHG emissions from operational transport would be 38 tCO_2e/annum.

Table 7.4 Transport emissions calculation inputs

Trip generation (annual, arrivals and departures)	Trip length (km)	Emission factor ($kgCO_2e$/v.km)
13,104	14	0.2113

GHG emissions from standby generators

7.3.19 Fuel combustion for electricity generation in the event of a utility power outage and during routine testing of the generators will cause direct and indirect GHG emissions.

7.3.20 As noted within the Air Quality Assessment, 14 No. 8.01 MW_{th} Rolls Royce MTU DS4000 20V4000 G94LF standby generators are proposed. These can be run on either mineral diesel,

[11] ONS (2022): Census travel to work, England and Wales. Version 4. [Online]. Available at: https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/employmentandemployeetypes/bulletins/traveltoworkenglandandwales/census2021, accessed 11/03/2025

[12] DESNZ (2024): Greenhouse gas reporting: conversion factors 2024. [Online]. Available at: https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2024, accessed 11/03/2025

a biofuel blend or fully on biodiesel (hydrogenated vegetable oil, HVO) which emits over 80% less CO_2e relative to the use of 100% mineral diesel.

7.3.21 Consistent with the assessment of air quality, a single annual 24-hour grid failure scenario is assessed, whereby the generators would operate for the entirety of that time to generate emergency electricity. This is considered a conservative estimate, noting the reliability of the grid (99.99605% availability). This assumption was tested on 20/21 March 2025 when a fire destroyed one of the 275/66kV NG transformers in the North Hyde Substation that supplies the site resulted in a power outage of <18 hours on UP1. This demonstrates the conservative nature of this approach.

7.3.22

7.3.23 Also consistent with the Air Quality Assessment, testing at 7.7 hours per generator per year is used. This is based on a five-year review, undertaken by the air quality consultants, of annual reports to the Environment Agency from two data centre campuses which indicated that actual planned annual maintenance and testing typically takes longer than anticipated due to problems identified during testing. This equates to a total annual operation duration of 31.7 hours per generator.

7.3.24 The net calorific value and the emission factor for mineral diesel and HVO, including scope 3 upstream emissions, has been taken from the DESNZ and BEIS company reporting factors. These are shown in Table 7.5.

Table 7.5 Standby generator emissions calculation inputs

No. gens	Thermal input (MW_{th}) each	Annual generation duration (hours)	Fuel	Net calorific value (kWh/kg)	Emission factor (kgCO_2e/tonne)
14	8.01	31.70	Mineral diesel	11.952	3,956
14	8.01	31.70	HVO	12.222	762

7.3.25 Taking into account the thermal power of the 14 standby diesel generators of 8.01 MW_{th} and the annual operation duration per generator, the total annual thermal power input from fuel required for the 14 generators equates to 3,555 MWh/annum. Using the net calorific values for mineral diesel and HVO, it has been calculated that 297 tonnes of diesel or 291 tonnes of HVO would be combusted by the generators. This equates to 1,177 tCO_2e/annum or 222 tCO_2e/annum respectively.

7.3.26 These are a worst-case estimates. GHG emissions from standby generation recorded across the applicant's sites in 2019-2023 (reported in the applicant's corporate Carbon Reduction Plan[13]) have ranged from 5 tCO_2e to 192 tCO_2e and the applicant has a target of 16 tCO_2e/annum across all its sites by 2030.

GHG emissions from refrigerant gas leakage

7.3.27 Leakage of fluorinated refrigerant gas (F-gas) from the HVAC systems of the Proposed Development will cause direct GHG emissions.

[13] https://arkdatacentres.co.uk/policies/Ark_Carbon_Reduction_Plan.pdf, accessed December 2024

7.3.28 The mass of F-gas to be used, and the annual and 'end of life' leakage rates are presented in the WLCA report accompanying this planning application. The WLCA report assumes that the R410a F-gas will be used for all systems, which has a Global Warming Potential (GWP) of 2,088 (with the AR4[14] GWPs used by the WLCA).

7.3.29 The total mass of R410a, its annual leakage rate and GWP is presented in Table 7.6.

Table 7.6 Refrigerant gas emissions calculation inputs

Total mass of refrigerant (kg)	Annual leakage rate (%)	'End of life' leakage rate (%)	GWP ($kgCO_2e$)
712.3	1	0	2088

Commented [TD2]: Query w/ HDR - seems v. low compared to Ark's own reporting and compared to another datacentre

Commented [TD3R2]: Resolved w/ Pip 28/03 - it's correct because using an evaporative cooling system

Commented [PS4R2]: Agreed

7.3.30 Considering the total mass of refrigerant and its annual leakage rate, it has been calculated that the mass of annual F-gas leakage will be approximately 7 kg per year. Taking into account the GWP of R410a, this equates to 14.9 tCO_2e/annum.

7.3.31 A 1% leakage assumption is in line with the applicant's corporate Carbon Reduction Plan, which targets achieving this leakage rate by 2030. The total refrigerant charge and hence leakage amount estimated by the WLCA is relatively low due to use of an evaporative cooling system.

7.4 Carbon Budgets

7.4.1 National- and local-scale carbon budgets, and carbon reduction trajectories or intensity targets, are used as part of the context for judging the significance of effect resulting from the impact of GHG emissions. This is discussed further in Chapter 7; the data referenced is presented here.

7.4.2 Table 7.7 shows the national carbon budgets and rate of reduction relative to the baseline of the budget for the 2018-22 period. The tCO_2e/annum and the percentage reductions have been calculated as a simple average across each five year budget period, not declining year on year within the period, and are shown as originally published (prior to EU ETS credit or any carbon border mechanism adjustment).

Table 7.7 National carbon budgets

Period	tCO_2e	tCO_2e/annum (simple average)	Reduction against 2018-22 as baseline
2018-2022	2,544,000,000	508,800,000	n/a
2023-2027	1,950,000,000	390,000,000	-23%
2028-2032	1,725,000,000	345,000,000	-32%
2033-2037	965,000,000	193,000,000	-62%
2038-2042*	535,000,000	107,000,000	-79%

**recommended by the Climate Change Committee in 2025; not yet adopted through legislation*

[14] IPCC (2007): Climate Change 2007: Synthesis Report. Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, Pachauri, R.K and Reisinger, A. (eds.)]. IPCC, Geneva, Switzerland, 104 pp. [Online]. Available at: https://www.ipcc.ch/report/ar4/syr/, accessed 11/03/2025

7.4.3 Baseline GHG emissions data is available disaggregated into local authority areas[15] and for certain economic sectors, of which 'commercial' and 'transport' are most relevant to this assessment. Table 7.8 shows the 2022 data (latest available). The 'total under local authority influence' excludes emissions from large industrial sites, railways, motorways, land-use, livestock and soils.

Table 7.8 Hillingdon baseline GHG emissions (2022)

Sector	tCO_2e/annum
Commercial	307,495
Transport	591,716
Total	1,510,457
Total under local authority influence	1,201,813

** only available as CO_2 (excluding other GHGs)*

7.4.4 The UK's national carbon budgets are broken down into devolved administration targets but not further to a regional or local authority level. However, the Tyndall Centre for Climate Change Research[16] has recommended local authority-specific carbon budgets up to 2100 that, in its research, are considered to be an equitable distribution and compatible with a 1.5°C-aligned trajectory for the UK. The Tyndall Centre carbon budgets sum to being more stringent than the UK national budgets: the carbon budget for Hillingdon would result in achieving zero or near zero carbon by 2043 at a carbon reduction rate of -12.5% per year from a 2020 baseline[17].

7.4.5 This is shown in Table 7.9. Again the annual figures are a simple average across each five-yearly budget period; the budget figure for the 2026-28 period (the assumed Proposed Development construction phase) is 1,090,000 tCO_2 using half a year of the 2023-27 period and one and a half years from the 2028-32 period.

Table 7.9 Hillingdon recommended carbon budgets

Period	tCO_2e	tCO_2e/annum (simple average)
2023-2027	3,100,000	620,000
2028-2032	1,600,000	320,000
2033-2037	800,000	160,000
2038-2042	400,000	80,000
2043-2047	200,000	40,000
2048-2100	200,000	40,000

[15] DESNZ (2024): UK local authority and regional greenhouse gas emissions statistics: 2005-2022. [Online] Available at: https://www.gov.uk/government/collections/uk-local-authority-and-regional-greenhouse-gas-emissions-national-statistics, accessed 11/03/2025

[16] Kuriakose, J *et al* (2022): Setting Climate Commitments for Hillingdon: Quantifying the implications of the United Nations Paris Agreement. Tyndall Centre. [Online] Available https://carbonbudget.manchester.ac.uk/reports/E07000196/, accessed 11/03/2025

[17] The Tyndall Centre defines zero or near zero carbon as achieving CO_2 levels >96% lower than in the Paris Agreement reference year of 2015, excluding non-CO_2 GHGs and aviation and shipping emissions. The carbon budgets are for energy-related CO_2 emissions only.